REMARKS

Re-examination and reconsideration of the subject matter identified in caption, pursuant to and consistent with 37 C.F.R. §1.112, and in light of the remarks which follow are respectfully requested.

Claims 1-33 were rejected under 35 U.S.C. §103(a) as unpatentable over Kildemo et al "Real time control of the growth of silicon alloy multilayers by multiwavelength ellipsometry", Thin Solid Films, Vol. 290-291; Dec. 1996; pages 46-50, in view of M. Kildemo et al, "A direct robust feedback method for growth control of optical coatings by multiwavelength ellipsometry", Thin Solid Films, Vol. 313-314; Dec. 1998; pages 484-489, for reasons set forth on pages 2-6 of the Office Action. Reconsideration of this rejection is respectfully requested for at least the reasons which follow.

The presently claimed invention relates to a method for controlling in real time, the fabrication of thin film structures such as multilayered optical filters and semiconductor components by techniques such as vapor deposition. The claimed method makes use of real-time ellipsometric measurements to monitor physical parameters relevant to a layer that is being grown in a stacked structure. More precisely, the ellipsometer measures at any time the variables I_S, I_C which are formally equivalent to the better known ellipsometric angles Ψ and Δ, but present advantages for the practical calculations for data treatment. The growth process is characterized by a trajectory in the (I_S, I_C) plane representing the locus of the continuum of the successive states of the structure being formed, from bare

substrate to complete filter. The trajectory can be also calculated theoretically from the given multilayer filter design and optical functions of the component materials that are used for each discrete layer. The continuous trajectories appear like a sequence of curves, separated by angular points corresponding to the change of deposited material when switching from one thin layer to the next one.

To achieve control of the film fabrication process, the present invention compares in real time the experimental trajectory to the theoretical one. It is assumed that the characteristics of the deposited materials do not differ too much from the nominal specifications, and the operating conditions are not readjusted to achieve a better fit during the growth of an individual layer. One only has to decide when the appropriate thickness has been deposited for the current layer, to then switch to the new set for process parameters corresponding to the next layer. To do this, one has to determine when the angular point corresponding to the end of the current layer has been attained experimentally. This means defining the criteria of comparison with the angular point of the theoretical trajectory.

Respectfully, the combined teachings of the cited documents does not disclose or suggest the method defined by claims 1-33.

The primary reference, Kildemo et al, discloses a method wherein one switches from layer n to layer n+1 at a time when the distance of the experimental trajectory to the theoretical angular point is minimal. Thus, the key point in the method proposed by this document is this: the factor used to decide when to switch from termination of layer n to deposition of layer n+1 is the minimal distance

between the experimental and theoretical angular points corresponding to the termination of each deposited layer. This method and the deficiencies thereof are discussed on page 4, line 19 to page 5, line 2 of the present specification.

Applicants' claimed method is clearly quite different. Applicants measure the length of the trajectory traveled in the plane of the variables [I_S,I_C]. The growth of a given layer n is considered to be terminated when the length of the experimental trajectory is equal to the theoretical one.

The secondary reference does not supply the aforementioned deficiencies of Kildemo et al. The article by M. Kildemo et al discusses the merits of prior methods. If the distance is monitored at any time without precautions, this may lead to inconsistent results. Consider, for instance, the case of an accidental erroneous measured point for I_S, I_C while the experimental trajectory is still far from the next angular point. If the erroneous measured point is substantially closer to the angular point than the others, the system will assume that the target is relatively close, which is in reality false, and the control process may fail.

To avoid this, M. Kildemo et al described an improvement in which the experimental/theoretical comparisons of the trajectories are taken into account only when one is reasonably close to the angular point. To appreciate the limit of this measuring window, it will be observed that one must follow the length of the experimental trajectories from the previous angular point and then decide to start distance estimations to the next theoretical angular point only when the experimental distance from the previous experimental angular point is about 90% of the distance

between the theoretical angular points n and n+1. From this point, the trajectories' lengths are no longer considered and their comparisons play absolutely no role in deciding when to switch to layer n + 1. The criterion of appreciation remains the minimal distance to the theoretical angular point.

Consequently, there is no disclosure in the secondary reference which would lead those of ordinary skill in this art to appreciate that measuring the trajectory lengths would provide a consistent criterion when deciding when to switch from layer n to layer n+ 1. The comparison of the lengths of trajectories is not, in general, a good indication of the proximity to the angular point and is not intended for it. In fact, the length comparison criterion that is the main object of the present invention was introduced because in some cases, due to cumulated experimental errors, the experimental trajectory departs too much from the theoretical one. In this case, the distance criterion fails but it was not obvious that in such case, the application of the length criterion could yield good results (fabricated filters with characteristics within tolerances) even though the experimental trajectory does not seem to follow the theoretical one. ?

The disclosure of the secondary reference referred to by the Examiner (page 486, left column beginning at lines 23) does not suggest a method whereby the length of the trajectory path traveled in the plane of the variables is measured and a comparison in real time is made between the experimental and theoretical trajectories. Accordingly, the §103(a) rejection should be reconsidered and withdrawn.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order and such action is earnestly solicited. If there are any questions concerning this paper or the application in general, the Examiner is invited to telephone the undersigned at (703) 838-6683 at his earliest convenience.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: November 3, 2003

By: George F. Lesmes
Registration No. 19,995

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620